FACSIMILE SERVICES IN MOBILE NETWORKS

TECHNICAL BACKGROUND

THE PROBLEM AREA

Problems with facsimile services in mobile networks are experienced due to the quality of the radio transmission. Longer delays and higher bit error rates than in the PSTN (Public Switched Telephone Network) cause facsimile transactions to fail more frequently in a mobile environment than in the PSTN. There are ways to avoid some of these failures, but which methods are the best is a subject for debate. The problem is to find a common platform to be standardised that will enable diverse competing solutions to be applied.

PRIOR ART

Facsimile services can be divided into two main categories. One is where the facsimile messages are both transmitted and acknowledged within one session. This kind of services is referred to as real-time fax. Another category is so called store-and-forward fax, where the facsimile is stored in a fax-box and transmitted to or from the mobile user by use of a file or message transfer program, for instance, e-mail.

The latter category lacks the feature of "immediate delivery", which in many occasions is seen as quite desirable, and therefor fails to meet a requirement that is often exhibited. This category will not be considered further in this document.

There are various standardised solutions for real-time fax in mobile networks. In GSM, there are two; a transparent and a non-transparent fax service. Although both have been standardised, the non-transparent service is not in use

because the transactions often fail. For this reason, the transparent fax solution is applied in GSM. However, in the PDC networks in Japan, a non-transparent fax serviced is used, which may be due to a better fax service specification in PDC than in GSM. Several actors in the PDC market have proposed to produced an enhanced version of the GSM non-transparent fax service specification for the 3rd generation mobile networks. The enhancements are to be based on the PDC standard.

In the Internet community, facsimile transmission over IP (Internet Protocol), usually referred to as IPfax, has been standardised. There are IPfax solutions for both real-time and store-and-forward. In ITU-T (International Telecommunication Union), these solutions have been captured in the T.38 and T.37 Recommendations respectively.

The T.38 recommendations specifies how the messages of the PSTN fax protocols (T.30 and T.4) are to be mapped onto IP. Delays occur in IP networks due to congestion. T.38 does not specify how these delays are to be handled for successful delivery of facsimiles; this is left to implementation. T.38 has therefore the wanted characteristics of a standard that allows competing solutions to evolve.

PROBLEMS WITH KNOWN SOLUTIONS

All fax service specifications for mobile networks, either for GSM or PDC or other, are very specific and constrain which solutions are possible. On one hand this has the advantage that the necessary software and hardware one the mobile side and that on the network side, can be provided independently yet allowing interoperability. On the other hand, any defects in the standards will penetrate all implementations of them and even small improvements may necessitate changes in the standards.

The real-time IPfax solutions apply to IP and it is currently not straight-forward to apply them to mobile networks. Real-time IPfax, does not specify how to handle delays in the IP network or high bit error rates. Moreover, IPfax does not specify how a mobile terminated call can be accomplished, since there are addressing issues to be solved.

THE INVENTION

SUMMARY OF THE INVENTION

The problems with the prior art solutions mentioned above is solved in a fax solution for mobile networks according to the present invention. According to the invention there is introduced an additional layer in the network for transporting fax messages. The additional layer is based on known IP protocols for fax transfer.

The advantage of this solution is that the fax transport protocol is tightly specified in the T.38 recommendation, which is an accepted standard, while the transfer mechanisms in the deeper layers are left to the preferences of the service provider. Users can easily adapt to different service providers.

The exact scope of the present invention is defined in the appended patent claims.

DRAWINGS

Figure 1 illustrates the architecture and protocol stack for real-time facsimile service according to the present invention.

Figure 2 illustrates an embodiment of the present invention where the fax gateway is separated from MSC by an IP network.

DETAILED DESCRIPTION OF THE INVENTION

The invention is of a fax service for mobile networks where the messages of the fax protocol (T.4 and T.30) are transported over an IP layer in the mobile network. The ITU-T T.38 protocol specifies how T.30 and T.40 is transported over the IP layer. The principles for overcoming long delays and errors described in GSM Technical Specification 03.46 (Non-transparent facsimile), or any enhancement thereof, are applied. Other implementation specific mechanisms can also be applied. These mechanisms are henceforth referenced in this document as 03.46+. The actual mechanisms of 03.46+ are out of the scope of this invention. The invention's core idea is to map the facsimile messages onto TCP or UDP packets and, in turn, map these packets onto the Radio Link Protocol (RLP) frames according to T.38, instead of mapping them directly onto RLP frames. TCP/IP header compression can be applied in order to reduce overhead. Figure 1 illustrates the protocol stack.

Call set-up and call control procedures are according to the protocol for existing data and fax services in the mobile network.

The terminal has two internal interfaces. First there is the interface between the Fax and the Adapter allowing a standard fax machine to be attached to the terminal. The other internal interface is between the "phone" and the adapter. This is an asynchronous (V.24) interface allowing transport of IP packets. The Fax and the adapter can be bundled into one product, a so-called Internet Aware Facsimile Device (IAFD), either as a special purpose fax machine or as a PC-like device. In case of a PC device, the adapter may be in form of downloadable software.

The adapter in the terminal and the fax gateway in the IWF are peers. (The Fax GW could alternatively have be called an adapter. Fax GW is chosen here to be compliant with T.38 terminology.) The 03.46+ is applied between the two peers. Note that, when 03.46+ maps fax protocol messages onto IP, it becomes an instance of T.38.

The 03.46+ protocol would specify how to handle delays and high error bit rates, and call set-up is not a problem either, since the call set-up procedure for fax calls in GSM or the actual mobile network can be applied. Therefor, 03.46+ and T.38 can be said to complement each other.

ADVANTAGES

An immediate advantage is that a split in the market, where irreconcilable solutions for fax in mobile networks may appear, can be avoided. If different solutions for the 03.46+ are implemented, users may easily adjust their equipment to different service providers by downloading the required adapter software (this applies to the case where the IAFD is a PC-like device). Another benefit is that the Fax Gateway could easily (once the addressing issues are solved) be moved across an IP network, as shown in Figure 2. No additional conversion is needed since the 03.46+ already is on an IP format. It also facilitates an evolution from 03.46+ to alternative instances of T.38, thus benefiting from the wider market that the Internet constitutes and its possibly cheaper and better products. The solution can also be adopted to packet switched transmission in the mobile network.